reasoning. This however we have not space to enter into, and it should be followed up after reading the book before us, in some of the more extended treatises mentioned in the bibliography in this book. Every student of mathematics ought to read through some book on logic, and the present one is an admirable introduction to the subject.

JAMES BYRNIE SHAW.

PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL AND R. P. BAKER.

PROBLEMS FOR SOLUTION.

Note.—An additional supply of good live problems is desired, especially in algebra, calculus, and mechanics.—EDITORS.

ALGEBRA.

When this issue was made up, solutions had been received for numbers 424–427

428. Proposed by FRANK IRWIN, University of California.

If the roots of the equation

$$x^n - na_1x^{n-1} + \binom{n}{2} a_2x^{n-2} + \cdots = 0$$

are all real, the condition that they should all be equal is $a_1^2 = a_2$. A proof of the sufficiency of the condition is readily obtained from a consideration of derivatives. A proof is desired not based on such considerations.

429. Proposed by C. N. SCHMALL, New York City.

It is given that d_1, d_2, d_3, are the greatest common divisors of y and z, z and x, x and y, respectively; also that m_1, m_2, m_3, are the least common multiples of the same pairs of numbers. If d and m are the greatest common divisor and least common multiple, respectively, of x, y, and z, show that

$$\frac{m}{d} = \left(\frac{m_1m_2m_3}{d_1d_2d_3}\right)^{1/2}.$$

430. Proposed by V. M. SPUNAR, Chicago, Illinois.

Solve the equations algebraically and also graphically: $x^y + y^x = xy, \qquad x^x + y^y = x + y.$

GEOMETRY.

When this issue was made up, solutions had been received for numbers 452–454

457. Proposed by NATHAN ALTSHILLER, University of Washington.

AB and AC are respectively a diameter and a chord of a circle whose center is O. The lines joining B to the extremities of the diameter perpendicular to AC, meet AC in the points M, N. Express the angle MON in terms of the angle CAB.

458. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

Given edges l, m, and n of a parallelopiped and the angles a, b, and c which the edges make with one another. Show that, if $s = (a + b + c)/2$, the volume equals

$$2lmn\sqrt{\sin s \sin (s - a) \sin (s - b) \sin (s - c)}.$$

459. Proposed by C. N. SCHMALL, New York City.

In a right triangle ABC, right-angled at C, a point F is taken in the side CB and perpendiculars CD and FE are dropped on the hypothenuse AB. Prove $AD \cdot AE + CD \cdot EF = \overline{AC}^2$.

CALCULUS.

When this issue was made up, solutions had been received for numbers 366–377

378. Proposed by ELBERT H. CLARKE, Purdue University.

The area of the curved surface generated by the revolution about OX of the portion of the curve $y = x^n$ which extends from the origin to the point (1, 1) is given by the formula

$$A = 2\pi \int_0^1 x^n \sqrt{1 + n^2x^{2n-2}}dx.$$

Our geometric intuition would tell us that the limit of this area as n becomes infinite is π. Give a strict analytic proof that

$$\operatorname*{Lim}_{n \doteq \infty} \int_0^1 x^n \sqrt{1 + n^2x^{2n-2}}dx = \tfrac{1}{2}.$$

379. Proposed by C. N. SCHMALL, New York City.

Express the equation of the folium, $x^3 + y^3 = 3axy$, in parametric form and find the area of the loop.

(From E. B. Wilson's *Advanced Calculus*, p. 296, ex. 5.)

MECHANICS.

When this issue was made up, solutions had been received for numbers 297, 301, and 302

303. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

A pile-driver weighing 500 pounds falls through 10 ft. and drives a pile weighing 400 pounds 3 inches into the ground. Show that the average force of the blow is $11{,}111\frac{1}{9}$ pounds.

NUMBER THEORY.

When this issue was made up, solutions had been received for numbers 224, 225, 226, and 229

228. Proposed by HERMON C. KATANIK, Indianapolis, Ind.

Deduce a formula for the difference between any two squares, and thus show that (1) The difference between any two consecutive squares is of the form $2p + 1$; (2) The difference between any two squares is even or odd according to whether they are separated by an odd or even number of squares; (3) The differences of the squares of the consecutive terms of any arithmetic progression form another arithmetic progression.

229. Proposed by WALTER C. EELLS, U. S. Naval Academy.

If p and q are integers and p is prime and positive, find the condition on q that the equation $p^x = qx$ shall have integral solutions, solve for x, and show that for a special value of p it has two solutions for a given q, otherwise only one.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

418. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

Form the algebraic equation whose roots are

$$a_1 = 2\cos\left(\frac{2\pi}{15}\right), \qquad a_2 = 2\cos\left(\frac{4\pi}{15}\right), \qquad a_3 = 2\cos\left(\frac{8\pi}{15}\right), \qquad a_4 = 2\cos\left(\frac{14\pi}{15}\right).$$